Attachment 6.1
In Response to Request 6

QUALCOMM

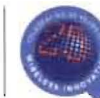## Supplemental Downlink Demo for FCC
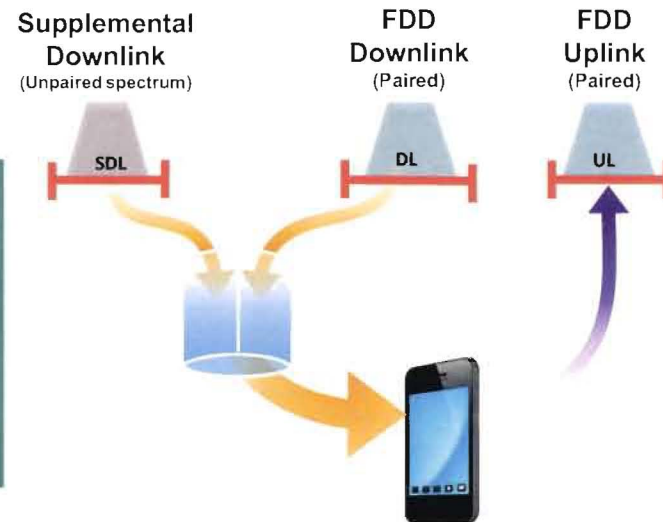Booth slides

May 11 2011

Attachment 6.1 in Response to Request 6
AT&T Inc.

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6.1-1

Supplemental Downlink Helps Ease Spectrum Crunch

- Uses unpaired spectrum for faster downloads & to support more users
- Addresses epicenter of spectrum crunch– more downloads than uploads
- Being standardized for LTE in LTE-Advanced. Demo uses HSPA+.

Supplemental Downlink (Unpaired spectrum)

FDD Downlink (Paired)
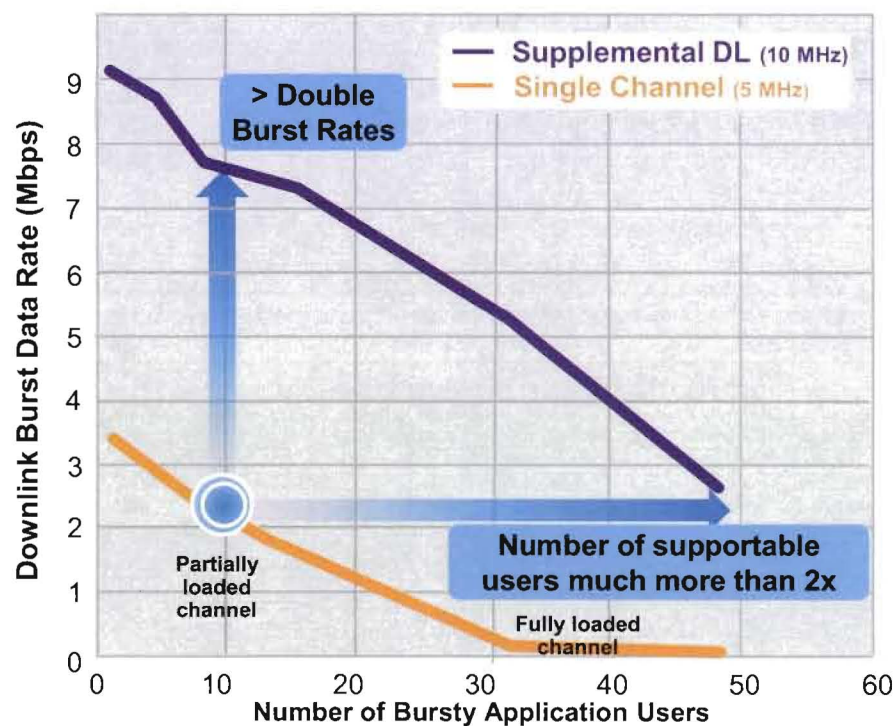
FDD Uplink (Paired)

SDL

DL

UL

- QC unpaired Lower 700 MHz D and E spectrum would be bonded with AT&T paired spectrum on which AT&T has deployed LTE (not 700 MHz), if ATT-QC deal is approved.
- Demo uses 2 x 5 MHz of AWS-1 paired spectrum & 5 MHz of unpaired spectrum at 1.4 GHz.

6.1-2

Attachment 6.1 in Response to Request 6

[1]Aggregation across bands already supported in 3GPP R9, but each additional band combination has to be defined in 3GPP.
[2]L-Band in Europe:1452 MHZ to 1492 MHz.

AT&T Inc.

2

Supplemental Downlink Supports Faster Downloads, More Users & Enhances the User Experience

Bursty Data Applications

Data bursts

Idle time

> Double Burst Rates

Number of supportable users much more than 2x

Partially loaded channel

Fully loaded channel

Supplemental DL (10 MHz)
Single Channel (5 MHz)

Downlink Burst Data Rate (Mbps) vs **Number of Bursty Application Users**
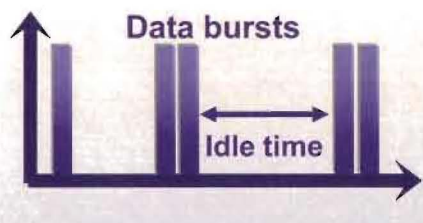
6.1-3

Attachment 6.1 in Response to Request 6
AT&T Inc.

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Qualcomm simulations. 16 R99 users on anchor channel and varying data users on 5MHz single or on 10MHz SDL channel 1km ISD, PA3, Pilot Power = 10% Other Overhead Power = 20%. R99 user power consumption = 20%. Lower control overhead on the SDL carrier: 10%. The bursty nature means that a multicarrier can support more users at the same burst rate for partially loaded carriers. The gain depends on the load and can exceed 100% for fewer users (less loaded carrier) but less for many users (starting to resemble full buffer).

HSPA+ Supplemental Downlink Demo, With L-Band

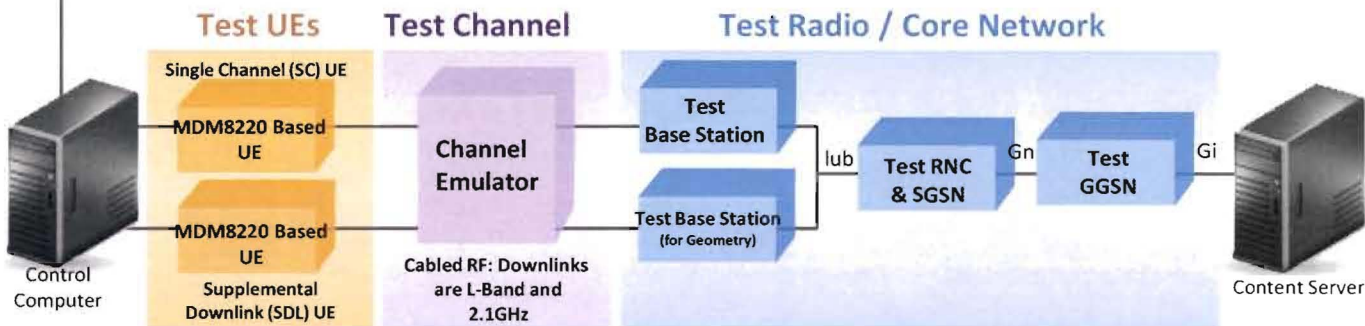**AT&T Innovation Center Washington, DC**

Display Computer

Real Time Display and Control of System Performance

Equipment Room, San Diego, US

Test UEs

Test Channel

Test Radio / Core Network

Single Channel (SC) UE

MDM8220 Based UE

MDM8220 Based UE

Supplemental Downlink (SDL) UE

Control Computer

Channel Emulator

Cabled RF: Downlinks are L-Band and 2.1GHz

Test Base Station

Test Base Station (for Geometry)

lub

Test RNC & SGSN

Gn

Test GGSN

Gi

Content Server

Attachment 6.1 in Response to Request 6 AT&T Inc.

6.1-4

4

**Attachment 6.2
In Response to Request 6**

This entire attachment consisting of 6.2-1 through 6.2-7 has been redacted.

Attachment 13.1
In Response to Request 13

Table 1
Carrier Aggregation Combinations for Multiple Band Scenarios (Inter-Band) in 3GPP Work Program (V5 6/1/11)

Current Work Items in 3GPP on LTE Carrier Aggregation for Multiple Bands (Inter-Band) (As of 5/31/2011 – information subject to change)					
3GPP Band	"Identifier"	Frequencies (MHz)	Region or Country & Operator	Notes	Work Item[1]
1 + 5	FDD x MHz Inter-band Non-contiguous (2100 + 850) 20 MHz (Band 1) + 20 MHz (Band 5)	1920-1980/2110-2170 824-849/869-894	No specific Region /Operator Scenario – (Generic Baseline)	Baseline CA work case for inter-band FDD	RP-091440 RAN #46 12/2009 RP-100661 RAN #48 06/2011
3 + 7 (EU)	FDD 40 MHz Inter-band Non-contiguous (GSM1800 + 2.6GHz) 20 MHz (Band 3) + 20 MHz (Band 7)	1710-1785/1805-1880 2500-	European Region European Operators (Orange,	Operator Requested WID	RP-100668 RAN #49 9/2010

[1] Work Item Descriptions can be found at: http://www.3gpp.org/ftp/Information/WI_Sheet/

Attachment 13.1 in response to Request 13

Current Work Items in 3GPP on LTE Carrier Aggregation for Multiple Bands (Inter-Band) (As of 5/31/2011 – information subject to change)					
3GPP Band	**"Identifier"**	**Frequencies (MHz)**	**Region or Country & Operator**	**Notes**	**Work Item[1]**
		2570/2620-2690	Telefonica, Telia Sonera, Telecom Italia)		
4 + 13	FDD 40 MHz Inter-band Non-contiguous (AWS + US 700) 20 MHz (Band 4) + 20 MHz (Band 13)	1710-1755/2110-2155 777-787/746-756	**United States** Verizon	Operator Requested WID	RP-101435 RAN #50 12/2010
4 + 17	FDD 40 MHz Inter-band Non-contiguous (AWS + US 700) 20 MHz (Band 4) + 20 MHz (Band 17)	1710-1755/2110-2155 704-716/734-746	**United States** AT&T	Operator Requested WID	RP-101391 RAN #50 12/2010
20+7	FDD 30 MHz Inter-band Non-contiguous (Europe 800 + IMT extension)	791-821/832-862	**European Region** European	Operator Requested WID	RP-110403 RAN #51

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13.1-2

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Current Work Items in 3GPP on LTE Carrier Aggregation for Multiple Bands (Inter-Band) (As of 5/31/2011 – information subject to change)					
3GPP Band	**"Identifier"**	**Frequencies (MHz)**	**Region or Country & Operator**	**Notes**	**Work Item**[1]
	10 MHz (Band 20) + 20 MHz (Band 7)	2500-2570/2620-2690	Operators (Orange, Telefonica, Telia Sonera)		03/2011
5+12	**FDD 20 MHz Inter-band Non-contiguous (850 + US 700)** **10 MHz (Band 5) + 10 MHz (Band 12)**	824-849/869-894 698-716/728-746	**United States** Cox Communications, Cellular South. US Cellular	Operator Requested WID	RP-110372 RAN #51 03/2011
4+12	**FDD 20 MHz Inter-band Non-contiguous (AWS + US 700)** **10 MHz (Band 4) + 10 MHz (Band 12)**	1710-1755/2110-2155 698-716/728-746	**United States** Cox Communications, Cellular South. US Cellular	Operator Requested WID	RP-110135 RAN #51 03/2011

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Current Work Items in 3GPP on LTE Carrier Aggregation for Multiple Bands (Inter-Band) (As of 5/31/2011 – information subject to change)					
3GPP Band	**"Identifier"**	**Frequencies (MHz)**	**Region or Country & Operator**	**Notes**	**Work Item[1]**
2+17	**FDD xx MHz Inter-band Non-contiguous (PCS + US 700) xx MHz (Band 2) + xx MHz (Band 17)**	1850-1910/1930-1990 704-716/734-746	**United States** AT&T	Operator Requested WID	RP-110432 RAN #51 03/2011
4+5	**FDD xx MHz Inter-band Non-contiguous (AWS + 850) xx MHz (Band 4) + xx MHz (Band 5)**	1710-1755/2110-2155 824-849/869-894	**United States** AT&T	Operator Requested WID	RP-110433 RAN #51 03/2011
5+17	**FDD xx MHz Inter-band Non-contiguous (850 + US 700) xx MHz (Band 5) + xx MHz (Band 17)**	824-849/869-894 704-716/734-746	**United States** AT&T	Operator Requested WID	RP-110434 RAN #51 03/2011

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Current Work Items in 3GPP on LTE Carrier Aggregation for Multiple Bands (Inter-Band) (As of 5/31/2011 – information subject to change)					
3GPP Band	"Identifier"	Frequencies (MHz)	Region or Country & Operator	Notes	Work Item[1]
Qualcomm Media Flo Spectrum (new 3GPP band) + 2	FDD xx MHz Inter-band Non-contiguous (PCS + Media Flo Spectrum) xx MHz (Band 2) + xx MHz (Media Flo Spectrum – as additional downlink) Note: 3GP Band number for Qualcomm Media Flo Spectrum not yet assigned)	1850-1910/1930-1990 Qualcomm Media Flo Spectrum (716-728)	United States AT&T	Operator Requested WID Note: 3GPP Band number for Qualcomm Media Flo Spectrum not yet assigned	RP-110435 RAN #51 03/2011

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Table 2

Carrier Aggregation Combinations for Multiple Band Scenarios (Intra-Band) in 3GPP Work Program (V5 6/1/11)

Current & Proposed Work Items in 3GPP on LTE Carrier Aggregation for Single Band (Intra-Band) (As of 5/31/2011 – information subject to change)					
3GPP Band	"Identifier"	Frequencies (MHz)	Region or Country & Operator	Notes	Work Item[2]
1	FDD 40 MHz Intra-band contiguous 2100 UL 20+20 MHz, DL 20+20 MHz	1920-1980/2110-2170	Global IMT Core Band Any operators licensed for IMT Core band	Baseline CA work case for intra-band FDD	RP-091440 RAN #46 12/2009 RP-100661 RAN #48 06/2011
40	TDD 40 MHz Intra-band contiguous 2.3 GHz UL/DL 40 MHz	2300-2400	Asia China Mobile Communications Co. (CMCC) & Chinese	Baseline CA work case for intra-band TDD	RP-091440 RAN #46 12/2009 RP-100661 RAN #48

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[2] Work Item Descriptions can be found at: http://www.3gpp.org/ftp/Information/WI_Sheet/

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Current & Proposed Work Items in 3GPP on LTE Carrier Aggregation for Single Band (Intra-Band) (As of 5/31/2011 – information subject to change)					
3GPP Band	**"Identifier"**	**Frequencies (MHz)**	**Region or Country & Operator**	**Notes**	**Work Item[2]**
			Operators		06/2011
38	**TDD Intra-band contiguous 2.6 GHz (China)**	2570 - 2620	**China** China Mobile Communications Co. (CMCC)	Operator Requested WID **New Work Item Proposal** - RAN #52 (31 May - 4 June 2011)	RP-110718 (proposed)
41	**TDD Intra-band contiguous 2.6 GHz (Americas)**	2496-2690	**United States** Clearwire, **South America** NII Holdings	Operator Requested WID **New Work Item Proposal** - RAN #52 (31 May- 4 June 2011)	RP-110673 (proposed)

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Attachment 13.1 in response to Request 13

8

References:

3GPP RAN TSG Plenary Reports:

RAN #46	01-04 December 2009	RP-100002	http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_46/Report/
RAN #47	16 - 19 March 2010	RP-100648	http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_47/Report/
RAN #48	01 – 04 June 2010	RP-100969	http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_48/Report/
RAN #49	14 – 17 September 2010	RP-101373	http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_49/Report/
RAN #50	07 -12 December 2010	RP-101363	http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_50/Report/
RAN #51	15 -18 March 2011	RP-11xxxx (draft report)	http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_51/Report/
RAN #52	31 May – 4 June 2011	RP-11xxxx (draft report)	http://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_52/Report/

3GPP Technical Reports:

TR 36.807   v0.1.0   http://www.3gpp.org/ftp/Specs/html-info/36807.htm

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Attachment 19(ii).1
In Response to Request 19.ii

This entire attachment consisting of 19(ii).1-1 through 19(ii).1-4 has been redacted.

DOCKET NO.   11-18

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